Thesis/
Reports
Croft

A CRITIQUE

of

AN ECOLOGICAL EVALUATION OF BIG GAME RIDGE Teton Wilderness Teton National Forest

U.S. Department of Agriculture

Forest Service
Intermountain Region

April 1973

Prepared by

A. RUSSELL CROFT

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ROCKY MOUNTAIN STATION

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April 1973

Prepared by

A. RUSSELL CROFT, Consulting Hydrologist[1]

January 1977

with a foreword by:

JOHN M. HERBERT and LEWIS K. CLARK

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[1] Formerly; Research Forest Hydrologist, Intermountain Forest and Range Experiment Station; and head, Section of Watershed Management, Region 4, U. S. Forest Service, Ogden, Utah; and Professor of Watershed Management, University of Arizona, Tucson; (1964 - 1967).

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EXPERIMENT STATION

FOREWORD

We have read critically "An Ecological Evaluation of Big Game Ridge", by George E. Gruell and the "Critique" prepared by A. Russell Croft.

We looked over Big Game Ridge in 1962 in connection with a General Integrating Inspection of the Teton National Forest and examined about 50 photos of the area taken by A. Russell Croft in August 1955. We counted approximately 305 elk in Wolverine drainage the day we inspected the area in August. Part of them disappeared over a ridge in a cloud of dust.

We have also read critically "Watershed and Range Conditions on Big Game Ridge and Vicinity" by A. Russell Croft and Lincoln Ellison (1960) and other statements dealing with the area in question.

It is our view that the Critique by Mr. Croft represents a fair, though critical, evaluation of Mr. Gruell's Report.

JOHN M. HERBERT

Assistant Regional Forester for the Intermountain Region from 1957 until retirement in late 1968. Prior to that period he was a ranger and forest staffman in Oregon, Forest Supervisor in Nevada and for nine years Assistant Director of the Division of Recreation and Land Uses in the Chief's Office in Washington D. C.

LEWIS K. CLARK

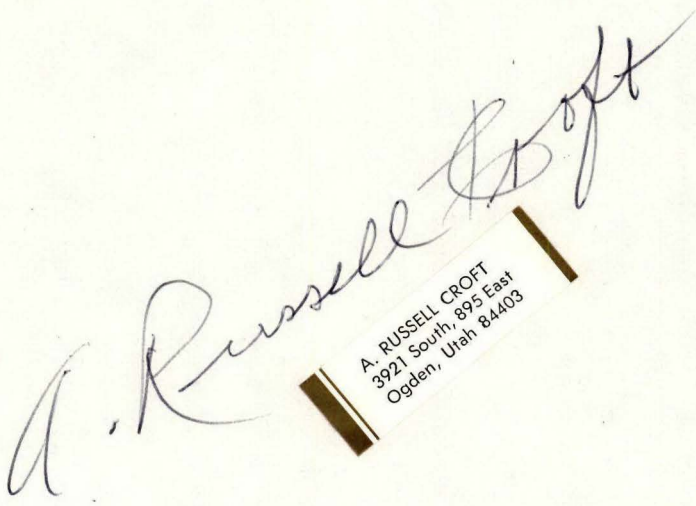
Retired Forester - 40 years service including 12 years as Assistant Chief of Information and Education, 4½ years as Section Head of Watershed Management, and 11 years as District Forest Ranger in Utah and Idaho.

EXPLANATORY NOTE

This Critique was prepared first in January 1974 in response to a request from D. M. Gaufin, Assistant Regional Forester, Division of Wildlife Management, U. S. Forest Service, Region 4.

Due to illness in the author's family, and accidents, this final draft has been delayed until May 1977.

The Critique has had critical review by several retired U. S. Forest Service Range-Watershed Ecologists of national and international reputation.



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SUMMARY OF THE CRITIQUE

1. The title is misleading. The paper falls far short of being "An Ecological Evaluation of Big Game Ridge". Its principal emphasis is our elk. Little or no data are presented on other biota, nor on hydrology, climate, soils, and vegetal components that are part of the overall ecology of the area.

2. The study plan is inadequate as a procedure to evaluate the complicated relationship of vegetation, soil, soil erosion, climate and hydrology on the 15,000 acre study area. The plan, apparently, was not submitted to qualified research workers for review and advice.

3. Little or no valid evidence is presented to support numerous claims and conclusions of condition of vegetation, soil erosion, rainstorm and snow-melt runoff, and watershed conditions. Generally, claims made for elk numbers and use during the study period are supported by sketchy and fragile data of very short duration.

4. Evidence provided by rephotographing locations depicted in earlier photographs, 50 to 100 years ago, has a questionable bias. None of the excellent photographs taken by Croft and Ellison in 1955 were repeated. Neither were those taken on Big Game Ridge as an integral part of the Parker 3-step transects in 1952.

5. Lack of accuracy in quoting or interpreting the reports of other investigators is displayed. On at least three occasions Croft and Ellison (1960) are misquoted

or quoted out of context. Whether quotations from other authors are inaccurate needs further checking.

6. Faulty understanding of the ecological processes involved in mountain watersheds and the orderly collection of evidence is responsible for the recommendation to dismantle exclosures. Exclosures are the best known method of providing data on watershed conditions in the absence of elk use.

7. The problems on Big Game Ridge, far from being solved as suggested in "Recommendations", remain wide open for further systematic study by a team of investigators experienced in ecology, hydrology, geology, soils, climate and game management in high mountain watersheds. Because this report has wide implications for wilderness areas, and national park and national forests, I strongly recommend such a study.

ORDER OF PRESENTATION

In presenting my comments on An Ecological Evaluation of Big Game Ridge, I have followed the topics as they appear, beginning on page 1, indicating the page, and where appropriate, specific paragraphs. This method has caused some redundancy but it appeared to be the best procedure to comment on specific items. At times, I have quoted rather extensively in an attempt to assure that points are not presented "out of context".

ABSTRACT (P. 1)

P. 1. Par. 1. "An Ecological Evaluation of Big Game Ridge", hereinafter called "The Report", is described as:

> "A study of the ecology of Big Game Ridge within the Teton Wilderness of Northwestern Wyoming carried out from June 1967-September 1971."

The title is misleading because The Report deals almost exclusively with the ecology of elk. There are practically no factual data presented on the numerous other ecological components of Big Game Ridge--plants, animals other than elk, climate, water, soils, geology, etc.

The second paragraph contains some revealing statements, which I quote completely to avoid getting out of context.

P. 1.P.1. "A historical review of the literature failed to substantiate certain premises concerning the history of Jackson Hole elk--notably that the areas under study were not historical elk range and that populations are presently higher than historical numbers because of supplemental feeding. The summer elk herd and vegetative cover evolved together. It is highly probable that prior to modern man's intrusion, wide fluctuation in elk population, a short season of elk use of subalpine areas and variable elk distribution influenced by seasonable weather differences interacted as a built-in safeguard against overuse of the forage resource."

The statement that "It is highly probable that prior to modern man's intrusion" a combination of factors "interacted as a built-in safeguard against overuse of the forage resource" is quite likely correct.

Admittedly then, man's use has caused overuse of the forage resource which is contrary to many of the claims made in the report, particularly that "....this region approximates pristine conditions more closely than anywhere in the nation..." (page 47, par. 8.)

METHODS
(P.P. 5-7)

Under "Methods" one would expect to find some sort of systematized objective study plan that would provide for collecting data on soils, soil erosion, vegetation, climate, hydrology, use by elk and other mammals, and snow cover during the grazing season on the study area. Then too, there is no way of knowing if the "Study Area" comprises the "15,451 acres" referred to in "The Study Area" (P. 9) or the small "selected" "Big Game Ridge Study Area" (Fig. 2. P. 5) in Wolverine Creek.

A summary of "Methods", described on PP. 5-7, follows:

P.5.Par.1 "The author observed Big Game Ridge, once from the air and three times on the ground during the summer of 1967 in the company of both Forest Service personnel and those of other agencies...to make a reconnaissance of the area while in the presence of those with varying opinions" (my emphasis).

Who were the people with "varying opinions"? The Report cites 76 "References Cited" of which only four deal directly with Big Game Ridge conditions since 1950.

(a) Beetle (1952) "...survey of Summer Range in the Teton Wilderness Area..."

(b) Deinema (1954) "Report on show me trip to Big Game Ridge..."

(c) Casebeer and Wogensen (1958) "Big Game Ridge Range Analysis..."

(d) Croft and Ellison report, (1960) "Watershed and Range Conditions on Big Game Ridge..." (1955 reconnaissance).

The Croft and Ellison report is diametrically opposed to the basic opinions expressed in the Gruell report. Croft was not invited to attend the "1967

reconnaissance", and Dr. Ellison was deceased (in 1957).

One wonders first who "those of varying opinions" were especially in the absence of their names, official connections, and qualifications to judge the complicated, biotic, edaphic, climatic, hydrologic, and soil erosion conditions on Big Game Ridge?

P.5.Par.2. "The transect was established in vegetation at about the 9.600 foot contour in the Middle Fork of Wolverine Creek, (see Fig. 2 and 5)...composed of 18-3'x3' permanent photo plots (quadrats)...spaced at irregular intervals over about one mile distance. Quadrat locations were principally selected to sample sites having low densities of vegetation and which had previously been believed to be in depleted condition." (My emphasis)

Location of quadrats at "irregular intervals", by "selection", so as to sample low density of vegetation in depleted conditions, certainly does not qualify as an objective fact-finding process. It suggests that the author was attempting to "prove" something.

P.5.Par.2."Data on phenology, elks use of vegetation, elk tracking on soils, and gopher disturbance were recorded in quadrats at recurrent intervals through the summer and fall of 1969-1971." (my emphasis)

The author's claim that data from these three seasons of use "provided an opportunity to assess biotic influences and the timing of these influences on the soil and vegetation" is an example of the far-reaching conclusions often made with little or no long-time supporting data.

P.7.Par.1."The relative abundance of elk was measured by means of 40-1/100 acre pellet plots paralleling the photo transects at two chain intervals...

"The relative abundance of elk" in the upper square mile of the Middle Fork of Wolverine Drainage, could likely be measured by 40 pellet sampling

plots along the one mile long transect, but these data could not possibly indicate, with any degree of reliability, the abundance of elk on the approximately 15,000 acre "Study Area".

P.7.Par.2."Rephotographing six photos taken in 1915 and 1928 ...Four other early high elevation scenes...included... to show trends on similar high elevation forb types."

Photographic lenses and film used in 1915 and 1928 reproduced ground cover differently than lenses and film used today. Conclusions drawn from such photo comparisons would be subject to question. Moreover, comparison of photo 40 to 50 years apart, even if accurate conditions are reproduced, can not show "trend"; they can show only "condition" at two widely separated points in time.

Croft and Ellison (1960) took 75 photographs on and near the Study Area in 1955, 47 of which are shown in their report. None of the originals nor retakes which could have been made 15-18 years later, are shown in the Gruell report.

P.7.Par.3."Soil samples were analyzed by laboratory and field examination...from soil pits dug on sites representative of contrasting conditions of vegetation to sample major soil types." (my emphasis)

Figure 5 shows the location of 6 soil pits near the head of the Middle Fork of Wolverine Drainage in an area approximately 3/4 mile square. Is this small heavily eroded area near the head of the drainage supposed to evaluate the soils of the "Study Area"?

P.7.Par.4."Past fire occurrence was investigated...by increment cores taken from trees established since the most recent fire." (my emphasis)

Why "the most recent fire"? The Croft and Ellison report showed photos

of tree roots exposed enough by erosion to be damaged by fire about 1886. By 1955 roots had been almost completely exposed by further soil erosion and the tree was dead (See Cover Photo).

P.7.Par.5."Elk movement and distribution were recorded during the course of 31 days in the field and during June flights over the study area." (my emphasis)

This statement seems to conflict with "Elk Observation" days in Table 1, page 11 which shows elk observation on only 14 days during The Study Period 1967-1971. (See Abstract par. 1)

Moreover, Table 1 gives only nine Elk Observation days by "Gruell (This Study)."

THE STUDY AREA
(P. 8)

The "Study Area" includes about 15,000 acres on the south end of Big Game Ridge south of Yellowstone National Park, comprising principally the Lake, West, Middle, and East Forks of Wolverine Drainage. (See Figure 5, "Big Game Ridge Study Area showing location of sites where sampling took place.")

Figure 9, Page 23 of the report is an "Aerial view of Big Game Ridge Study Area on June 25, 1971, showing location of enclosure and snow conditions". I estimate snow cover about 95%.

In addition to Figure 9, several other photos show patches of snow during most of the elk grazing season. For example:

Figure 10--June 24, 1969.

Figure 11--July 8, 1969; July 16, 1970; July 14, 1971.

Figure 15--August 13, 1969.

Figure 19--July 24, 1928.

Figure 20--September 4, 1893; September 10, 1968.

Figure 23--July 14, 1971.

Snow cover in July 1969, 1970, 1971 (Figure 11) "suggests that some areas near the "Big Game Ridge exclosures" are free from snow, if at all, for only a few weeks during the growing season.

For serious elk damage at snowbanks see Croft and Ellison, Figures 10 and 11 where elk harve churned the soil into mud-puddles, presumably while watering at snowdrifts.

It is difficult, if not impossible, to conclude that such ideal sites for spring growth, (considering the elevation), have not been a favorite spring and summer grazing ground for elk for a long, long time. Heavy damage to vegetation and soil under the snow conditions shown in the report's photos would be an inevitable result of elk use.

THE PHYSICAL ENVIRONMENT
(P.-13)

P.13 Physiography.

> "The study area of the head waters of the Middle and West Forks of Wolverine Creek (Figure 5) is strongly dissected and has been considered the primary area of poor hydrologic condition on the Forest segment of Big Game Ridge. A series of deeply entrenched gullies is the predominate land feature."

Why would an investigator locate a "study area" in such a non-typical section of Big Game Ridge?

P.13 Climate

No measurement of rain or snow was made on the study area.

One would expect that a study of this kind, which was apparently intended to answer many of the unknows of the Big Game Ridge problem, would have included a few year-long type precepitation gauges and certainly periodic (as the area was visited) snow-cover maps, snow depth, and water content.

P.16. Par.2. Geology

> ...At present, slope erosion is very minor and restricted to times of spring runoff and occasional summer rains. There is probably less erosion at present than during the dry years of the 1930's though no record of erosion in the area at that time is available."

When was a "record of erosion in the area" ever made or observed, or for that matter even guessed at?

The above statement "slope erosion is very minor", ignores the numerous photos in the Croft and Ellison Report which illustrate facts contrary to this opinion. Moreover, such glaring evidence of current erosion, as pedistaled plants, soil relicts, deep raw gullies, and sediment, including boulders, and recent debris flows stick out like sore thumbs in many places. Nor does the Report mention the voluminous research studies on the devastating runoff and soil erosion that have, and may occur, under conditions of slope, vegetation, and soil much like those on Wolverine drainage and particularly on the "Study Area" at the headwaters of the Middle and West Forks. One would expect some analagies would be observed from these studies that would have significance to the sparsely vegetated slopes of Wolverine drainage.

> The Report states that "Hot house samples of Big Game Ridge soil samples seeded to oats suggested production of vegetation was being suppressed by some factor other than soil fertility." (my emphasis)

These soil samples, were presumably taken from the heavily eroded "soil study area" in upper Middle Fork of Wolverine Creek (Figure 2). In view of the favorable "soil fertility" reported from the laboratory tests, and with more than 50 choice sedge, grass and forb species, largely indigenous to the area, that represent the acme of range and watershed plants on western mountain watersheds, why is there little or no regeneration of the vegetal cover on the study area? This seems to be a paradoxical situation until we examine some of the present conditions that are strong inhibitors of restoration of the vegetal cover such as, a harsh micro-climate, scant seed germination and even less seedling survival, soil disturbance by rainstorm runoff, early and constant trampling by elk, etc.

To conclude this comment on "Soils" in The Report, there is little doubt that soil erosion has slowed over the years as the pristine top soil has eroded down to the rather compact, and more erosion-resistant subsoil, possibly the "C" horizon in some places.

And it is in this highly eroded upper Middle Fork area of Wolverine Creek that the six soil pits were dug (Fig. 5) that were used to characterize the soils of the 15,000 acre Study Area (Appendix III). There appears to be little scientific expertise or objectivity in evaluating the soils of either the 15,000 acre study area or even the upper middle fork of Wolverine drainage.

WATERSHED CONDITIONS AND EROSION
(P.-17)

It is about this section of The Report that I will direct critical attention beginning with paragraph 1.

P.17.Par.1

> "Since the late 1940's, the condition of the Big Game Ridge watershed and accompanying erosion rates have been the primary subject of concern and discussion . It was commonly accepted that the hydrologic condition was poor and of rather recent origin. Conclusions were based upon a high incidence of erosion pavement, sparse ground cover, pedestaled plants, gullying and deposition of debris in the lower drainages. It had been concluded that most of the topsoil had been eroded away resulting in a widespread prevalence of erosion pavement. The overall prevailing condition was likened to overgrazed and damaged livestock range in Montana, Idaho, Wyoming, Utah, Nevada and other western states (Croft and Ellison, 1960).

This paragraph appears to be the author's summary of the findings reported by Croft and Ellison (1960). It is inadequate. I mention just one item: The Croft and Ellison report shows 44 photos in and around the "Study Area" in Wolverine drainage, all but 4 of which literally scream with evidence of current (1955) and past accelerated soil erosion, rainstorm debris floods and other forms of uncontrolled runoff, sedimentation and plant destruction. In fact the photo on the front cover shows a tree that had its roots exposed enough about 90 years ago (about 1885) to be scarred by fire. Since that event the tree's principal root system has been completely exposed by accelerated soil erosion and the tree had been dead for many years. Other dead trees show the same condition.

Moreover, more than 50 photographs by Croft (Aug. 18-23, 1955), many of which show current, and past destruction of soil, plants, and particularly the hydrologic characteristics were sent to the Teton National Forest Office in Jackson, and were

also filed in the Regional Office of the Forest Service (Range Management).

These photos should ignite a spark of curiosity. Then too, they show only part of the evidence of the destruction (rape of the land if you please) that has occurred in Wolverine drainage and vicinity in the past 100 years and quite likely before.

The second paragraph of this section ("Watershed Conditions and Erosion") cites some recent observers and investigators:

P.17.Par.2.

> "L. A. Stoddard speculated that the range had been in better condition in the past. How much better he did not speculate. Conclusions were based on dead plant segments, erosion pavement and lichen cursts (Deinema, 1954). Wertz (1970) concluded that much of the poor hydrologic condition was new in origin--probably less than 100 years. Reason for this view was expressed as follows: 'If the present erosion forces and patterns has been active and developing for a longer period, the topography would be much different than presently exists.' Diem and Kennington (1963) point out that the slow percolation rates for Big Game Ridge soils tested suggest how easily water runoff could reach proportions to cause serious soil erosion."

It is clear that Wertz (1970) and Diem and Kennington (1963) lean towards hydrologic changes on "Big Game Ridge". There is no way of knowing, however, what exact relationship, if any, that "Big Game Ridge" has to the "Selected" small "Area studied".

The "early water runoff" suggested by Diem and Kennington is apparently snow-melt runoff although the statement does not so state.

Studies by this writer and others show that snowmelt surface runoff and soil erosion even from bare ground with soil mantles with low infiltration capacities is minor to nil compared to rainstorm runoff, and particularly from

torrential summer rains (rates from 5 in./hr. to 8 in./hr. for 5 minute periods).

There are a number of reasons for this:

1. Snow melt rates 1" to 2" per day (from sunup to sundown) are usually much less than even the slowest infiltration rates. (inches of water)

2. Close contact of the melting snow-pack with the bare soil surface is a strong deterrent to over-surface flow during melting. Frequently, also, a head of water may build up in the snow, above the soil surface, which tends to inhibit surface flow between the soil surface and the snow-pack.

Research reports on rainstorm runoff and soil erosion and floods from sparse cover of vegetation (much of it about like that on Wolverine drainage) are too numerous and universally available to justify mentioning here.

Continuing this section on "Watershed Conditions and Erosion", I will comment on paragraph 6, P. 17.

P.17.Par.6.

"From the foregoing one can appreciate that watershed conditions on Big Game Ridge are 'poor' when the usual criteria are applied and on certain sites the plant cover and soil makeup is inadequate to inhibit rapid runoff (Fig. 6). However, despite past interpretations, the question as to whether the erosion rate and watershed condition are natural geologic or an accelerated condition brought on by processes attributable to modern man has not been satisfactorily answered." (my emphasis)

Here the author appears to be junking the "usual criteria" (whatever they are). It is not quite clear what other proven criteria he is substituting, if any.

Paragraphs 7 and 8, page 17 contain three items of questionable validity that need to be given sharp attention. Accordingly I will quote all of these

paragraphs.

P.17.Par. 7.

> "A valuable aid in evaluating current watershed conditions is an awareness of how these watersheds appeared in the past. Fortunately, two professionals described conditions in the 1870's.

P.17.Par.8.

> "Barlow (1872) writing of the condition of the Snake River in the Crooked Creek locale states, 'The stream is one of the principal branches of Snake River, has a rapid current, and is subject to severe freshets.' Bradley (1873) also comments on the wide variability of runoff by saying, 'The mountains shut off the winds on all sides, and the valley lies so well to the sun that the snows must melt rapidly here, thus causing the great freshets of which the broad, gravelly bottom of the river below had already given so abundant evidence.' Bradley also contrasted the stability of Heart River with other streams of the area where great freshets were common. On the prevalence of erosion, he made the following comment: 'The upper slopes of the ridge on either side are mostly bare of timber and many parts of them are badly washed'."

P.17.Par.9.

> "Though brief, these accounts demonstrate that the watershed in given localities during the 1870's was subjected to heavy runoff in the tributaries which was accompanied by deposition of debris in the lower drainages. The slopes, being of erosive sedimentary material, were also badly washed in many locations."

Regarding paragraph 7, it is somewhat amusing how the author drags out two unknown "professionals" of 1872-73 vintage and ignores, and misquotes, Croft and Ellison, who in 1960 had a total 70 years experience in observation, study, and experimentation, and about 60 publications on soils, ecology, forest hydrology, range management, snow melting and runoff, accelerated erosion, etc., etc. of wild mountain lands in the Intermountain Country.

As stated in paragraph 8, Barlow (1872) observed some serious runoff conditions "of the Snake River in the Crooked Creek Locale". Bradley (1873) also

observed variable and serious runoff in the same general area, with specific comparison to "the stability of Heart River".

Bradley's reference to the "mostly bare of timber" and eroded slopes of "the ridge" apparently refers to Chicken Ridge north of the Snake River in the vicinity of Heart River--not Big Game Ridge, because the areas referred to are 5 to 10 miles north of Big Game Ridge Study Area.

There is little doubt, however, that Barlow and Bradley observed some serious runoff and erosion conditions North of the Snake River. If they made reference to watershed conditions on the "Big Game Ridge Study Area" they are not reported by Gruell.

Fortunately the Report shows a photo by Dr. Vernon Bailey in August 1915 (Figure 12, page 26) with bare eroded ground that aptly can be described as a flood and erosion source area. This locale was practically the same except for more tree growth when photographed in 1955 by Croft and Ellison.

Wildfire--P.18

On the subject of fire, The Report quotes Croft and Ellison as follows:

> "Ellison and Croft (1960) noted the evidence of early burning throughout the Big Game Ridge region. A ring count of a small conifer suggested an extensive fire about 1885." (my emphasis)

This quote is misleading, and inadequately reflects the views of Croft and Ellison on fire as a factor in damage on Big Game Ridge. First, the ring count reported by Croft and Ellison (1960)(outside front cover) reported a spot burn about 1885, not "an extensive fire about 1885". Secondly, Croft and Ellison

(1960) reported on the conspicuous Mink Creek fire of 1937 and went on to say that ..."limber pine on Big Game Ridge, now 10 to 15 feet high, has come following a rather extensive burn probably about 1885". (See P. 33)

The question here is not whether the Croft and Ellison views on fire are correct or incorrect, the point is that their statement has been twisted rather liberally.

THE VEGETATION
(P. 20)

Composition

Under this head The Report gives some extremely significant data but questionable conclusions.

P.20.Par. 1.

> "...Seventy plant species were collected by the author during the summer of 1968 and 1969 (Appendix II). The collection was made entirely in the Middle Fork of Wolverine Creek Study Area with the exception of a few specimens from the Boundary Trails on the East Fork of Wolverine Creek." (my emphasis)
>
> Composition was:
> "Grasses, sedges or rush--14 plants
> Shrubs--1 plant
> Forbs--55 plants"

With this great variety of choice plants "on the area...in the Middle Fork of Wolverine Creek" to supply seed for regeneration, this writer agrees with the earlier statement by Gruell that "production of vegetation was being suppressed by some factor other than soil fertility." (P. 16).

As stated previously, could the reasons by any chance be, active soil erosion, harsh micro-climate, absence of topsoil for seed bed, and perhaps a few

elk trampling along this "migration route"?

Phenology (p. 21)

I am impressed here with Figure 9, page 22, which shows almost 95% snow cover on upper Wolverine Creek on June 25, 1971. These snow cover conditions have been discussed under "The Study Area", (P. 2) so will not be repeated here.

The Report seems to ignore the possibility of elk trampling along the snow drifts in wet soil as they move with the melting snow to get water and a few sprigs of emerging vegetation.

I just doubt that elk keep back a "safe distance", waiting for a dry soil and "vegetative readiness" and other "hokus pokus" that use to be associated with wise grazing use.

Plant Succession (p. 23)

P.23.Par. 1.

> "Long Term Trends. Previous investigators have questioned whether the current vegetal regime on sparsley vegetated sites is representative of the 'original' vegetation. Croft and Ellison (1960) concluded that residual-resistant tuffs of oval-head sedge could well be the only component of the original vegetation left as a result of excessively heavy elk use."

Croft and Ellison made no such "Conclusion". Briefly stated here is what they said (pp. 9-10):

"...Possibly residual-resistant tufts of ovalhead, sedge represent a portion of the original cover (Fig. 8). These tough-rooted sedges have so tough a sod that they can resist trampling and exist longer on pedestals of soil than other species can."

"...on the slopes of the North Fork of Wolverine Creek, we found one stand of vegetation that had been heavily trampled but which strongly resembled the type of vegetation that has been considered pristine in the sub-alpine zone of the Wasatch Plateau (Fig. 9). The exposure was southwest; the slope was rather steep, averaging perhaps 50 percent. On areas little disturbed by elk

trampling, cover was as follows: about 65 percent vegetation, 20 percent litter, and 15 percent bare ground. Mountain bluebell and duncecap larkspur were dominant species. Other conspicuous species included lambstongue groundsel, mountain brome, slender wheatorass, hood sedge, thickstem aster, yarrow, mountain lupine, Englemann aster, one-flower helianthella, sticky geranium, Porter ligusticum (loverroot), sweetanise, pedicularis, and arnica."

"It may seem incredible that such lush, dense vegetation once dominated the open parklike uplands of Big Game Ridge, for no evidence of this can be seen now. However, these species have been found growing in equally exposed situations in the sub-alpine zone of the Wasatch Plateau."

Paired Photos (p.p.26-35)

P.34.Fig.20.

The Report states that, the 1968 photo indicates invasion of sedge, as compared to the 1893 photo, 76 years earlier. This is certainly a questionable comparison because it ignores 60 to 70 years history of possible soil erosion, and vegetation destruction and invasion on the site. On this point Croft and Ellison report as follows (p. 11):

"Soil Remnants"

"In general, pedestaled plants are neither as common nor as widespread on this range as on other deteriorated subalpine ranges with which we are familiar. This is probably because the extreme amount of trampling here destroys the pedestals (soil remnants on which plants are perched). A most commonly observed pedestaled plant is hoodsedge. The tough sods evidently resist trampling. In cutting through these pedestals to separate the portion above the root crown from the pedestal proper underlying it, one can commonly find an indication that 1, 3, or even 4 inches of soil has been washed away (Fig. 8). It is not at all clear, and cannot be clear without further study, whether these pedestals represent the original soil surface or whether these sedges have become established on an eroded surface." (my emphasis)

By far the most significant features of the two photos in Figure 20. P. 34 is snow drifts of the previous winter still on the ground in early September, 1893 and also in September, 1968.

In view of the short growing season and harsh climate at elevation 10,100

experience of 50 years has taught that even limited grazing use by livestock and big game that follow the receding snow in high mountain watersheds may upset the delicately balanced "Watershed Complex" of vegetation, soil stability, micro-climate, precipitation and runoff control that exists on such areas.

There is little doubt that such an upset has occurred on the area shown by Fig. 20 quite possibly a hundred years ago or longer.

The Report presents numerous retakes of early photos to show that little if any change in vegetation has occurred in the past 56 years in the Study Area. This is not surprising in view of the large elk population reported by casual explorers and inspectors as far back as 135 years ago.

Accordingly some selected references from the report on elk numbers will be cited along with Gruell's conclusions as to the slight vegetal changes over the years.

P.24.P.4. "Historic photos of vegetation on Big Game Ridge suggest no material change in composition and if anything, show an increase in plant cover during the past 56 years. These and other photos of high elevation sites show exceedingly slow plant succession on subalpine tall forb ranges or no change. (Figures 12-21)."

P.24.Par.7. "My interpretation of these photos is that the tall forb community is essentially a climax vegetation. Naturally occurring local "Zootic climax" sites result from recurrent use by elk. Changes in the vegetation in historic and recent photos appear to be related to variations in growing seasons, the influence of the pocket gophers and/or possible climatic changes."

Without commenting on these unsupported claims it will be appropriate to record briefly some reports of elk populations given in the Report.

P.10.Par.9. "An estimate of 5,000 elk on Big Game Ridge and

Two Ocean Plateau in 1915 suggests they were frequenting the area in large numbers (Rosecrans 1915). Four or five hundred were observed in the general area of the present study in August 1915 (Bailey 1915)".

SUMMARY OF ELK REPORTS PRIOR TO 1900, BIG GAME RIDGE REGION (P.P. 53-57)

This appears to be a very thorough report of early observations of elk in the general area. Excerpts from a number of the quoted reports are given below because they indicate that elk were apparently far more numerous, and frequently concentrated in large numbers, 100 to 135 years ago in the Big Game Ridge Region than during "The Study Period" from July 11-1967 to August 1971, when elk were observed on only a total of 14 days. (Table 1, page 11.)

Early Reports of Elk

North shore Yellowstone Lake, 1836. "...Scattering groves of tall pines forming shady retreats for the numerous Elk and Deer during the heat of the day."

East of Yellowstone Lake, 1837. "We found the whole country swarming with Elk..."

South slope Mt. Washburn, 1870. "The ground was everywhere tracked by the passage of herds of elk and mountain sheep. ..."

Inlet Yellowstone Lake, 1870. "The ground was trodden by thousands of elk and sheep."

Big Game Ridge, September 13, 1872. "This is mostly fine grazing grounds and the numerous game-trails give evidence that it is frequented by deer and elk. Indeed we found two herds of elk of about 20 each among the groves on the top of the ridge."

Yellowstone River. "Some 10 miles above outlet into Yellowstone Lake, 1873. ...It now appears that the top of the hill was used as a stamping-ground for elk... ...they had made such a broad trail leading up to it (hill top) as to completely deceive us."

Several Miles above Cascade Creek, October 23, 1876. "... I had ridden close up to at least two thousand elk. They had been lying in the snow..."

Southern Yellowstone-Teton Wilderness, 1880's-90's. "...yet the first heavy autumnal snow will drive them from the mountains to the low lands, the freshly fallen snow being tramped down by hundreds of elk tracks coming from all directions."

Big Game Ridge, September 1891. "On top of the first plateau where black spruce groves were strewn across the grassy surface, we saw a band of elk, cows and calves, trotting off through the rain."

Table 1.p. 11. "Study Area Bailey, August 19, 1915, 400-500 elk".

There can be no argument with the author's claim that little if any vegetal change has occurred in the past 56 years. However, it is apparent from recorded elk citings that they have exerted a big influence on soil, vegetation, micoclimate, and the general hydrology of the Study Area.

The present watershed conditions may be characterized as "Zootic Climax" (P. 24) but the history of game management in many areas has taught that perpetuation of the species and the lands on which they live at times can be done only by artificial destruction of the offending animals to prevent destruction of soil and vegetation on which their existence depends.

P.36.Fig.22. "Vegetative conditions on Big Game Ridge exclosure on August 15, 1967 (left) and July 14, 1971 (right) grazed range on the left in both photos."

Presumably these photos are intended to show "before and after" conditions. However, they do not show the same area. The difference in location of the photos is obvious.

BIOTIC INFLUENCES OF THE VEGETATION

Elk Foraging (p. 37)

P.37.Par.3 "There is no indication of a concern over forage utilization on Big Game Ridge or adjacent ranges during early years. Graves and Nelson (1919) alluded to this area as being ideal summer range and having long been the resort for a great number of elk. Bailey (1915) provides the first qualitative evaluation by a biologist of forage utilization on Big Game Ridge. His field notes of August 19, 1915, describe elk foraging as follows:

P.37.Par.4. "In places where the big herd was feeding (study area at the headwaters of middle fork and west fork of Wolverine Creek), the grass showed evident signs of having been grazed, but there was still abundance in the most grazed spots. No discrimination in kinds was noticed and the sedges (Carex and Luzula) were also eaten. Wild timothy and redtop were abundant on the slope, but seemed not to be specifically sought out." (my emphasis)

P.37.Par.5. "Bailey and Simpson (1915) further describe the elk summer range situation in these terms:

> "The summer range of elk, both in and around Yellowstone Park is fortunately ample, not only for the present herds, but for many times their number. Certainly 100,000 elk could summer in the Yellowstone Park and as many more outside toward the south. Even where they were most numerous and the ground well tramped by their footprints, the grass and native plants were full of flowers and seeds and showed almost no signs of grazing. In a few spots on Big Game Ridge, the Two Ocean Plateau, and Cliff Creek the elk herds had remained long enough in the same locality to make some impression on the amount of grass, but in no place was one-half of the forage utilized."

The Report makes two important points here that I will emphasize:

(1) Elk were numerous on Big Game Ridge in 1915 and,

(2) Forage seemed to be plentiful even in the "study area" "...(where)

grass showed evident signs of having been grazed, but there was still abundance on the most grazed spots". (my emphasis)

In view of these facts I ask: What caused the vegetation deterioration since then? (See Fig. 2, 3, 4 and 8, about 60 years later). The evidence strongly suggests that uncontrolled use by elk has been the major cause.

I quote further from Gruell on "Biotic Influences of Vegetation" (P.37):

P.37.Par.7. "More recent investigations have concluded that the sparsely vegetated exposures on portions of Big Game Ridge formerly supported a better vegetative cover. Beetle (1952) reasoned that the elk preferred the south slopes which were the most susceptible to overgrazing. Croft and Ellison (1960) came to a similar conclusion in stating: "destruction of vegetation and soil on that part of Big Game Ridge...is largely a result of excessively heavy use by elk. Apparently much use occurs in the spring when only the windswept ridges are free of snow and before any notable plant growth has occurred." Anderson (1958) also came to the same conclusion."

P.37.Par.8. "Seven years of aerial and ground observations have established that the first arrivals of elk at the higher elevations on Big Game Ridge usually occur during the first week in July (Table 4). Although the soil surface is largely bare of snow, elk distribution is principally below 9,600 feet in elevation. Only a few small scattered groups frequent the study area at this time."

See approximately 95% Snow Cover on the study area on June 25, 1971 (Fig. 9)

P.37.Par.9. "Table 5 demonstrates that elk foraging in quadrats is light through the second week in July. Herbage removal up to this time was almost entirely confined to the terminal ends of a limited number of species per quadrat where foraging had occurred. This finding does not support the idea of some past investigators that early season foraging by elk, particularly adjacent to snowbanks, had caused a deterioration of the grazable vegetation." (my emphasis)

Here again we have the falacious conclusion that "Seven years observation", (The earliest seasonal on July 11, 1967 and the latest seasonal August 12-13, 1969 --a 29 day annual seasonal time-span--(See table 4) demonstrates beyond any doubt that:

(1) This has been the pattern of use for the past 100 years or more is hardly better than a crystal ball conclusion, and

(2) That because "This finding does not support the idea of some past investigators" (presumably Bettle (1952), Croft and Ellison (1960) and Anderson (1958), and others that these men have "missed the boat," so to speak, in evaluating Big Game Ridge deterioration.

Trampling and Tracking (P.P. 40-41)

Here is another point on which Croft and Ellison (1960) have been misquoted.

> "The occurrence and effect of elk trampling and/or tracking was followed through periodic inspections of permanent quadrats and repetitive observations in the general area (Table 5). Particular emphasis was placed on early season observations, as this was the time when damage was believed to occur". Croft and Ellison, 1960)"

Here is what Croft and Ellison actually said about trampling damage (P. 31): under "Evidence of Elk Damage":

"The most clear-cut evidence of elk damage is the trampling already reported. There appears to be hardly a square foot in this country that is not trampled once, or more frequently, each season by elk. Indeed, trampling appears to be most serious effect that elk have on the range, because, while their utilization of the vegetation is evident, it is by no means so complete as one would expect from the vast number of their tracks."

"On August 22, we visited an area where we had seen elk feeding 2 days before (Fig. 28). The vegetation here was very scattered, and most of the ground was bare. The species utilized especially heavily were thickstem aster and Pseudocymopterus, each probably to an average of 70 percent. Elk also readily take pale agoseris. In fact, they take a little of everything, including nodding bluegrass,

mountain lupine, tongueleaf violet, western yarrow, slender wheatgrass, and Bear River fleabane. In this particular area it was clear that elk had also grazed earlier this year, both from the evidence of old tracks and prior utilization. Probably, in the present depleted state of the vegetation, the amount of utilization of it made by elk is harmful. On the other hand, if the area were supporting a vegetation of which it is capable, a much larger amount of forage would be available with considerably less proportionate use of the plants. This would be tolerable, providing the season-long repeated trampling could be avoided." (my emphasis)

Is this accurate scientific reporting of other peoples statements?

Continuing the discussion of "Trampling and Tracking" (P. 41), the report again misquotes Croft and Ellison.

P.41.Par.3. "Another area of comparable trampling was on the northeast side of the pass separating the middle fork of Wolverine Creek from a tributary of the Snake River. This site was reported upon by Croft and Ellison (1960) and is an extreme situation as the main migratory trail crosses a late melting snowbank. Total area trampled was estimated at one acre." (my emphasis)

Here is what Croft and Ellison said: "Trampling displacement of soil: (P. 11)

(See also their figures 10, 11, 12):

"Widespread pounding and churning of the soil by the hoofs of elk is recorded everywhere. Much of this trampling evidently is done while the ground is wet; it is a probable consequence that many perennials are killed while a habitat is being provided for annuals (Fig. 10). Another example of trampling displacement of soil is found on a steep, stony eastern exposure on the east side of Big Game Ridge (Fig.11). Since this area is practically free of pocket gophers, they contribute very little to the soil disturbance; but the soil is heavily trampled by elk and the downward displacement of soil is obvious. On steeper slope, the perennial grasses have been overturned so that the shoots are growing out parallel to the slope, and the downward displacement is otherwise evidenced by stones on plants. In a fairly representative spot on this slope, we estimated that there was 40 percent rock, 50 percent bare ground, 5 percent litter, and 5 percent plants. On the gentler portions of this slope, the plants are markedly pedestaled,"

Pocket Gophers (P. 41)

P.41.Par 1. "In earlier studies on Big Game Ridge, Laycock (1953) Croft and Ellison (1960), and Diem and Kennington (1963) found pocket gophers numerous as evidenced by winter casts, mound counts and trapping."

The Croft and Ellison statement on pocket gophers can hardly be included in this catch-all reference. Here is what they said:

"Evidence of Pocket Gopher Damage": (P. 31)

"In most open places, we found winter cores and summer mounds made by pocket gophers (Fig. 29). The presence of pocket gophers is considerably less evident than the presence of elk. Gopher workings were not found in dense timber or in very wet meadow soils, and only to a minor extent in rocky soils. The extent to which pocket gophers throw up mounds as a result of the elk's trampling and breaking through their burrows was not ascertained, but it has been observed in other places that trampling by sheep does stimulate pocket gopher activity. Possibly some of the summer activity we saw was stimulated by destruction of burrows by trampling of elk."

Thus Croft and Ellison stated that they saw evidence that pocket gopher activity is stimulated by elk activity. The Report's quotation makes no reference to this observation.

DISCUSSION AND CONCLUSIONS
(P.P. 46-47)

This part of The Report is notable for such things as: subjective reasoning, often without adequate facts, and "Conclusions" based on little or no evidence. For example:

P.46.Par.7. "The high elevation of the Big Game Ridge summer range subjects it to a wide range of weather extremes. Snow can fall during any month but usually occurs between early September and late June. A more or less continuous snowcover through the third week in June usually inhibits plant growth until the first week in July. Snow banks persist on many sites through the third week in July. The prevailing climate is harsh as indicated by an estimated annual mean temperature of 21°F. Heavy frosts can occur at anytime during the summer months. All things considered, the severe climate is a significant deterrent to optimum plant growth."

I agree in general with this statement but hasten to ask: How does the author

account for the rather lush growth of vegetation adjacent to "the study area" on the East, South, and North of the head of Wolverine Creek where practically the same conditions exist? This is somewhat analagous to the old cliche, "does a fence change the climate?" (See Fig. 9 of Croft and Ellison).

Here is another hard-to-understand opinion (or conclusion) based on limited or no data at all:

P.46.Par.5. "Where snowbanks persist, harsh microclimates appear to be the primary deterrent to the development of dense plant cover. Plant productivity is high where soils are deep loams underlain by clay. Productivity is directly related to soil depth and moisture availability."

I don't agree that "harsh microclimates" have any significant relation to "where snowbanks persist". The sun can shine just as intensely; the wind can blow with equal velocity a few hundred feet from snowbanks as on the edge of snowbanks. But, on the edge of snowbanks there may be, and most often are, other factors involved that influence "plant productivity" such as elk trampling wet soil and plants (if per chance there are plants present). See Croft and Ellison (1960) Figures 10 and 11.

Here is another historical-ecological "blockbuster" presented by Gruell as, "This author's interpretation".

P.46.Par.6. "This author's interpretation, in light of new information, suggests today's watershed conditions on Big Game Ridge are not unlike those of 100 years ago. Prevailing hydrologic conditions are considered to be a natural phenomenon, being primarily the product of geologic processes..." (my emphasis)

What "New Information"?

The author asserts here that his 5-6 year study comprising a total of 14 days

"Elk Observations on Big Game Ridge..." has provided "New Information" that suggests little or no change in "Watershed Conditions" or in "hydrologic conditions" over the past 100 years. No evidence is presented to support these claims. On the contrary, the Croft and Ellison Report shows 40 photographs that clearly indicates that the exact opposite is the true condition.

P.46.Par.7 "Past evaluations of watershed conditions appear to have been lacking in historical perspective. The use of standard indices such as erosion pavement in measuring conditions also may have misled some observers. This indice has proven reliable when studying conditions on abused livestock ranges. It may need to be interpreted much differently when applied to historic game range. The presence of erosion pavement on Big Game Ridge is not considered to reflect accelerated soil losses. Rather, the gravel occurring in the soil profile is continually being exposed to the surface, primarily by pocket gopher activity, and is not the result of disturbance by elk concentrations." (my emphasis)

In this paragraph the author suggests that thousands of competent researches and observers "...lacking in historical perspective..." have somehow "missed the boat" in evaluating watershed and range conditions.

I submit, that, cows, sheep, goats, horses, deer, and elk can damage high mountain watershed lands by grazing, "too early", "too late", "too intensely", and "too much". They can puddle the soil along the edge of wet snow banks, and it doesn't matter a great deal what kind of hoof is doing the damage. (See Croft and Ellison Figures 10 and 11.)

Par 47.Par.3. "In summation, measurements from this and other studies suggest that forage utilization on Big Game Ridge has not been excessive. Data indicate that adequate herbage is left to manufacture the food needed for plant growth and reproduction. Had this

> not been the case over the years, the vegetation trend indicated in Figures 12-17 would be downward rather than upward or unchanged." (my emphasis)

This conclusion "that forage utilization on Big Game Ridge has not been excessive" seems to contradict the statement in the "abstract" (P.2. Par.2.) that since man's intrusion there has been overuse or misuse of the forage resource on Big Game Ridge. Here the author appears to be "straddling the fence" to use a common cliche.

Moreover, there are no firm data to support the claim that "forage utilization on Big Game Ridge has not been excessive" since man's intrusion".

As for the paired photos in "Figures 12-17", the 40 to 55 year gap between photos certainly puts a big question mark on their validity because there may have been numerous "ups and downs" in elk use, rainfall, snow-cover, temperature, and other factors that could change trend.

As for the "vegetation trend indicated" in Figures 12 and 13, they do show some change. But change in vegetation, as claimed, is practically nil in the paired photos in Figures 14, 15, 16, and 17.

In my view The Report places too much emphasis on vegetation for forage when as a matter of fact the big problem is now, and has been for a long time in the past, vegetation as part of the "hydrologic complex"--That is, the control of water (rainfall and snow-melt) on the land.

Numerous experiments have clearly shown that unless this control is properly maintained, the soil will be lost by accelerated erosion, and with it, all or part of the "forage". Accordingly vegetation for "forage" is of secondary importance and not a primary need of plants as The Report suggests. None of the photos in

Figures 12-17 show vegetation adequate to control rainfall runoff, and particularly not from torrential rainfall.

P.47.Par.8. "Despite these indicators of habitat deterioration, one is forced to question whether the harsher appearing areas of the watershed were ever capable of supporting a vegetal cover more lush than that at present. Extended observations soon suggest that strong abiotic limitations to plant establishment and production occur at various sites. The added advantage of observing other high elevation ranges in the Teton Wilderness and Yellowstone Park region in combination with the availability of historical photos makes one soon appreciate that sparsely vegetated localities are not the end product of overgrazing. As this region approximates pristine conditions more closely than anywhere in the nation, it becomes evident that 'poor ground cover' and raw appearing watercourses are geologically and climatically determined and are inherent to this region. Those who have not had an opportunity for extended observations have been at a distinct disadvantage in evaluating conditions on Big Game Ridge." (my emphasis)

One is impelled to ask: Is the author attempting to re-define "pristine" ("former, primitive, pertaining to the earliest time or state; original").

The author next reasons from the falacy of "approximate pristine" to the equaly unsupported conclusion that "poor ground cover, raw appearing water courses are geologically and climatically determined". Here the report seems to rule out the slightest impact of elk in producing these conditions.

For a few photos showing rape of the land by elk (with their "tell-tale" footprints in the puddled soil) See Croft and Ellison (1960).

RECOMMENDATIONS
(P. 48)

I will quote and comment on each of the four paragraphs in the following order: Par. 2; Par. 3; Par. 4; Par. 1.

P.48.Par.2. "It is recommended that no consideration be given in the future to contouring, seeding, or gully plugging watershed improvement practices. Any manipulations of this nature are not in keeping with the Wilderness Act. This study has demonstrated that watershed conditions on Big Game Ridge are natural-geologic rather than man-induced. Management direction should be one of recognizing a natural condition and treating it accordingly." (my emphasis)

The claim that the study has demonstrated that "watershed conditions on Big Game Ridge are natural geologic..." has practically no supporting evidence, as has been stated previously.

P.48.Par.3. "It is recommended that the pellet transect be measured each September. Continued sampling will be invaluable in establishing variables in yearly elk utilization on Big Game Ridge."

The pellet transect consists of "40-1/100 pellet plots paralleling the photo plot transects at two chain intervals" (See page 7, par. 1, and Fig. 2, page 5). By no stretch of the imagination can elk use be determined on the 15,000 acre study area by this isolated, hand-picked sample in the highly eroded west fork of Wolverine drainage. If quadrat 8, (Fig. 3, page 6) is representative of the vegetation along the photo plot transect, parallel to the pellet plots, elk would tend to avoid this area for lack of feed.

P.48.Par.4. "Quadrats and camera points should be rephotographed at periodic intervals for purposes of further documenting differences between short term change and long term trend."

Here the author proposes to "document differences between short term changes and long term trend", by periodic rephotographing of quadrats and camera points, selected to sample sites having low densities of vegetation and which have previously been believed to be in depleted condition" (Page 5, Par. 2).

The 18 plot transect referred to could possibly have some values in measuring "Trend" on the "elk migration trail" in the Middle Fork of Wolverine Creek, but nowhere else. Such methodology and reasoning is purely subjective and is totally lacking in scientific investigative procedure--particularly for the 15,000 acre study area."

P.48.Par.1. "It is recommended that the Big Game Ridge and Gravel Creek exclosures be dismantled. These structures have served a useful purpose in providing sites where ungrazed range could be compared to grazed range. Heavy snow loads have badly deteriorated the Big Game Ridge exclosure, making upkeep prohibitive. Considering study findings, maintenance costs, and wilderness management direction, the continued upkeep of these facilities is unjustified. Removal of the exclosures should be coordinated with the University of Wyoming to prevent loss of study data." (my emphasis)

I will comment on two points here.

First: In view of more than 50 years experience in restoration of vegetation on high mountain (9,500 feet elevation) range watersheds with and without exclosures, it is folly to expect significant vegetal trends to appear in 6 years (See Fig. 8, page 22).

The second item in paragraph one of the "Recommendations" that Big Game Ridge and Gravel Creek exclosures be dismantled will be given extensive

treatment because of its far-reaching implication.

There is a basic management philosophy involved here. Will the "Climatic Climax" concept, as a tool for determining site potential, be abandoned for the relatively new Zootic climax concept? This latter involves the impact of large ungulates such as elk, moose and deer as "natural" long-time components of the range-watershed complex.

This is indeed correct until the impact of man-made influences such as winter feeding, complete protection, partial protection, poisoning of predators, etc. begin to influence the elk population by increasing their numbers, and to a lesser extent their use patterns. At some point in this process, in many historic instances, the ungulates begin to outrun their food supply. The natural results are overuse of the vegetation thus lowering carrying capacity, excessive soil compaction, erosion of top soil, and deterioration of the hydrologic characteristics of the area involved.

At some point in this process, control of animal numbers is taken over naturally by starvation, predators, and disease, and unnaturally, by killing campaigns, and other means.

It is imperative, then, that exclosures be maintained as a management tool for two main purposes: (1) to determine the "climatic climax" (the site's maximum potential) and, (2) the point in time when animal numbers begin to exert a deteriorating influence on the habitat.

Various aspects of the zootic climax have been presented by Cole (1971).[1] Beetle (1974)[2] sounded a warning to the effect that:

"Some ecologists are using the term "zootic climax" in the same sense that range managers use the term 'zootic disclimax". If our national parks are to be managed in order that they be natural, it will be important for administrators to understand these two terms and how they differ from the Climatic Climax."

"An Ecological Evaluation of Big Game Ridge" seems clearly to abandon the "Climatic Climax" concept as a measure of wild land potential for the comparatively recently introduced "zootic climax" which is being used by the U. S. National Park Service in Yellowstone and Grand Teton National Parks.

In applying the zootic climax philosophy, where elk are a major component of the complex, National Park Service officials regard "exclosures" as an unnatural element in the environment that produce unnatural conditions.

On this point, in 1972, Superintendent Gary E. Everhardt of Grand Teton National Park wrote Senator Clifford Hansen of Wyoming as follows:

> "...Misinterpretations of the situation within exclosures are often made. It is commonly assumed incorrectly that the condition inside the exclosure is the natural condition. The National Park Service has received no information which indicates a valid need for the continued maintenance of the four exclosures within Grand Teton National Park. Since they constitute a departure from natural conditions,

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[1]Cole, Glen F. 1971. An ecological rationale for the natural or artificial regulation of native ungulates in parks. Trans. of the 36 North Amer. Wildl. and Natur. Resources Conf. pp. 417-425. Cole, Glen F. 1971. Some considerations in the use of exclosures to assess the biotic effects of herbivores and departures from natural conditions in Yellowstone National Park. National Park Serv. Inf. Pap. No. 13, 5 p. processed.

[2]Beetle, Alan A. "The Zootic Disclimax Concept," Journal of Range Management, Vol. 27, No. 1, January 1974, pp. 30-32.

> are a significant aesthetic intrusion and are sources of public confusion and misinformation, it is not deemed wise to continue spending public funds for their maintenance. When a voluntary work force was made available for removal of two of the exclosures, advantage was taken of the circumstance."

The Forest Service has long regarded exclosures as a valuable management tool. They are not completely "natural" as Superintendent Everhardt points out because they exclude large ungulates, but they do provide a standard of condition which aids in determining how far use by elk, sheep, cattle, goats or other ungulates can be allowed to use a related site without damage (and frequently irrepairable damage) to the hydrologic properties, and the forage production properties of wild lands.

Strict adherence to the "zootic climax" philosophy of management could, in time, and without control of the animal element (elk) as a component of the complex, result in deterioration of wild lands almost to the point of no return. Elk then become their own worst enemy, as Croft and Ellison (1960) point out (See Foreword).

In this writer's view, based on easily recognizable evidence, that is what has happened on much of that part of Wolverine drainage that is the subject of this "Critique".

The recommendation "that the Big Game Ridge and Gravel Creek enclosures be dismantled" suggest that there is no longer a need for knowing what the potential of these lands would actually be if the "Climatic Climax" were allowed to assert itself.

One is impelled to ask: Has this new philosophy of range-watershed management been adopted by the U. S. Forest Service?

APPENDIX

In order for the reader to better understand some of the conditions on Big Game Ridge in 1955 when the Croft-Ellison inspection was made, several photos are included in this Critique.

Those marked with "Figure 10" for example are from A. Russell Croft and Lincoln Ellison, "Watershed and Range Conditions on Big Game Ridge and vicinity Teton National Forest, Wyoming"; U. S. Forest Service, Ogden, Utah, October 1960.

Photos marked with an asterick(*) are part of the complete photo record of their 1955 inspection filed in the offices of:

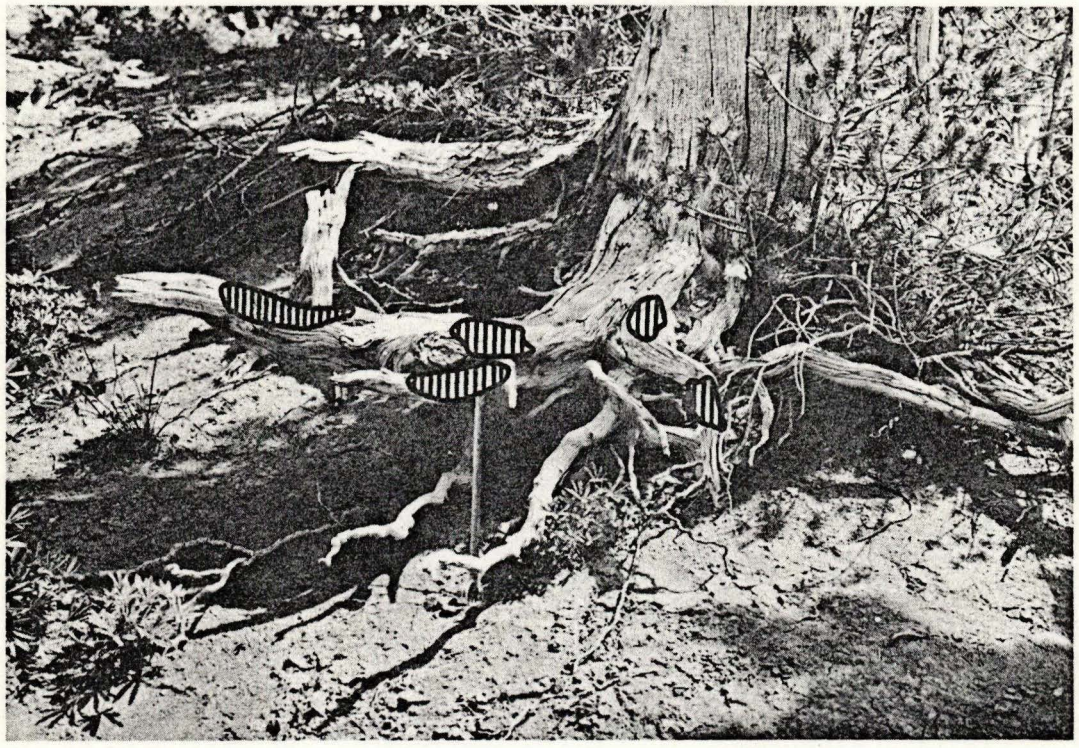
The Intermountain Forest and Range Experiment Station, Ogden, Utah

Regional Office, U. S. Forest Service, Ogden, Utah

Teton National Forest, Jackson, Wyoming.

WATERSHED & RANGE CONDITIONS ON BIG GAME RIDGE & VICINITY

TETON NATIONAL FOREST, WYOMING



by

A. Russell Croft - National Forest Administration.
Lincoln Ellison - Intermountain Forest & Range Experiment Station.

FOREST SERVICE,
U. S. DEPARTMENT OF AGRICULTURE,
OGDEN, UTAH.

Oct. 1960. (Front Cover from Croft and Ellison Report)

No. 75. Another photograph of the group that made the Big Game Ridge inspection during the period August 17 to 23, 1955. Shown in front of Fox Creek Patrol Cabin No. 229, just inside Yellowstone Park are--front, left to right--Gaufin, Anderson (Wyoming Game and Fish Commission), and Deinema. Back row--Safran, Ellison, Adams, Patterson (Wyoming Game and Fish Commission).

8/23/55 A.R.C.

* A. Russell Croft - 1960.

FOREWORD

Since about 1876 the large elk populations in and around Jackson Hole, Wyoming, have been the subject of considerable study and widespread popular concern. This concern has given rise to campaigns to "Save the Elk" from the ravages of those who would subject them to unnecessary slaughter and from the encroachment of man on the animal's habitat, particularly their winter feeding grounds.

More recently a third enemy--a more insidious one--has appeared in the form of damage--and in some cases destruction--of the soil and vegetation on the high mountain range-watersheds which supply most of the elk's spring, summer, and fall feed.

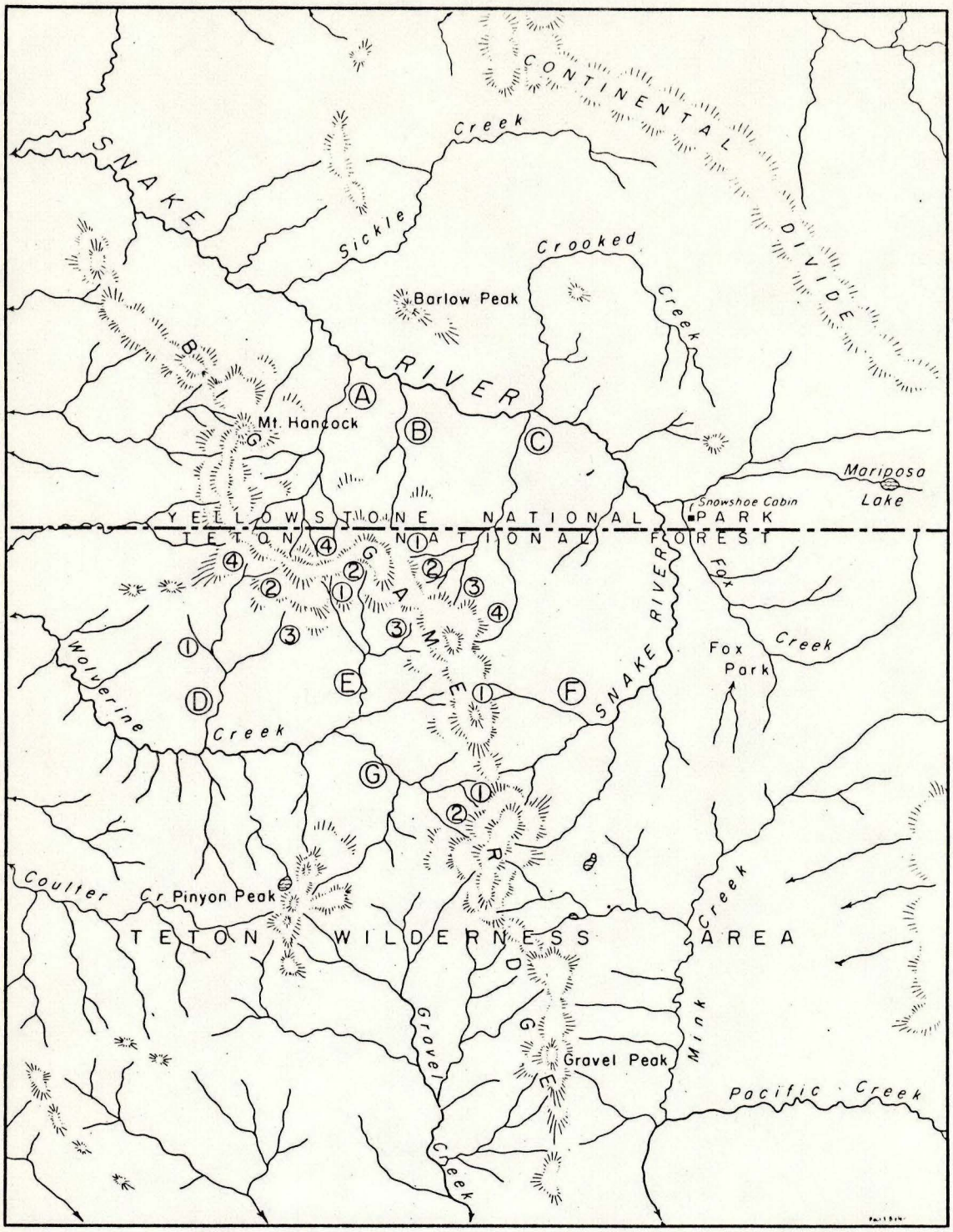
Damage to these vital resources that has resulted in low productivity of forage--and in some cases no productivity at all--cannot long continue without serious consequences. The problem is real and vital. It has many aspects that reach far beyond the welfare of the animals themselves because erosion of watershed soil also affects water quality, streamflow characteristics, fish habitat, aesthetic values, and the economy of local communities.

The problem calls for statesmanlike action by all those interested in the welfare of the elk and the range and watersheds on which they depend. A program of management that will assure perpetuity of the elk and the related soil and forage resources is urgently needed.

Regional Forester

Director

COVER: Remains of a limber pine tree on Big Game Ridge probably killed by fire. Age-studies (1955) made of average size trees that came in after the burn established the age of the oldest trees at about 70 years which suggests the fire occurred about 1885. Only spots on the upper part of the roots have been burned (crosshatched) which suggests that most of the roots now exposed were covered with soil when the fire occurred.



BIG GAME RIDGE AND VICINITY

TETON NATIONAL FOREST

YELLOWSTONE NATIONAL PARK

SCALE

Scale 0 1 2 3 4 5 Miles

Source USGS Lake Quadrangle, Wyoming

Map from Croft and Ellison Report. Letters and numerals were used for lack of Drainage names.

Figure 10.--These steep eroded gully slopes show the manner in which elk disturb the soil. Presumably the trampling begins while the gully is completely filled with snow and only the ridgetops are showing. The elk work along the contact line between the steep slope and top of snow deposit, cropping the sedges as they are exposed by snow melting. This process continues until the snowpack has completely melted from the gully; this leaves the slopes in a much puddled and pockmarked condition.

Figure 13.--Boulders deposited by floods in lower reaches of Wolverine tributaries D and E.

15

Figure 9.--This herbaceous cover on a west-facing slope in Wolverine tributary E-2, exhibits a very good mixture of grasses and forbs, presumably a remnant of the pristine cover. Counts of droppings, and bed grounds indicated that this area was receiving relatively heavy use by elk at time photograph was taken.

the slopes of the North Fork of Wolverine Creek, we found one stand of vegetation that had been heavily trampled but which strongly resembled the type of vegetation that has been considered pristine in the subalpine zone of the Wasatch Plateau (fig. 9) (1). The exposure was southwest; the slope was rather steep, averaging perhaps 50 percent. On areas little disturbed by elk trampling, cover was as follows: about 65 percent vegetation, 20 percent litter, and 15 percent bare ground. Mountain bluebell and duncecap larkspur were dominant species. Other conspicuous species included lambstongue groundsel, mountain brome, slender wheatgrass, hood sedge, thickstem aster, yarrow, mountain lupine, Engelmann aster, one-flower helianthella, sticky geranium, Porter ligusticum (loverroot), sweetanise, pedicularis, and arnica.

It may seem incredible that such lush, dense vegetation once dominated the open parklike uplands of Big Game Ridge, for no evidence of this can be seen now. However, these species have been found growing in equally exposed situations in the subalpine zone of the Wasatch Plateau.

Figure 7.--Gully pattern at the head of Snake River tributary A-4. Bare soil and extensive rills and gullies indicate very serious rainstorm runoff.

Plant Composition

In many places annuals, particularly Douglas knotweed, were dominant species. Other annuals found were slenderleaf collomia, cluster tarweed, and groundsmoke. On extensive areas, pale agoseris was practically the only plant species seen; the small rosettes were regularly and distantly spaced.

Invasion of Perennials

There is some evidence that perennials are invading such areas. For example, at the head of Gravel Creek, an area with a western exposure about 25 percent steepness, we estimated 35 percent vegetation, 15 percent litter, and 50 percent bare ground. There is a mixture of many newly established perennial plants upon an area dominated by such annuals as Douglas knotweed, with a small amount of slenderleaf collomia. In some other areas we also found considerable tarweed-dominated patches of vegetation. The most strikingly abundant of the grasses is oniongrass.

* No. 20. This photograph shows conditions in a migration route of elk immediately north (probably 200 or 300 feet) of the drainage shown in the preceding pictures. Note how the erosion of soil has left roots exposed in the gully bottom. Here also may be seen the carcasses of two and probably three elk. This area, as yet, has not produced a mud flow.

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* No. 9. Another view of mud-rock flow in the head of Wolverine Creek in the close vicinity of those shown in photos Nos. 6 and 7. This photo shows a flow probably less than 10 years old which has been deposited on top of some of the older flows.

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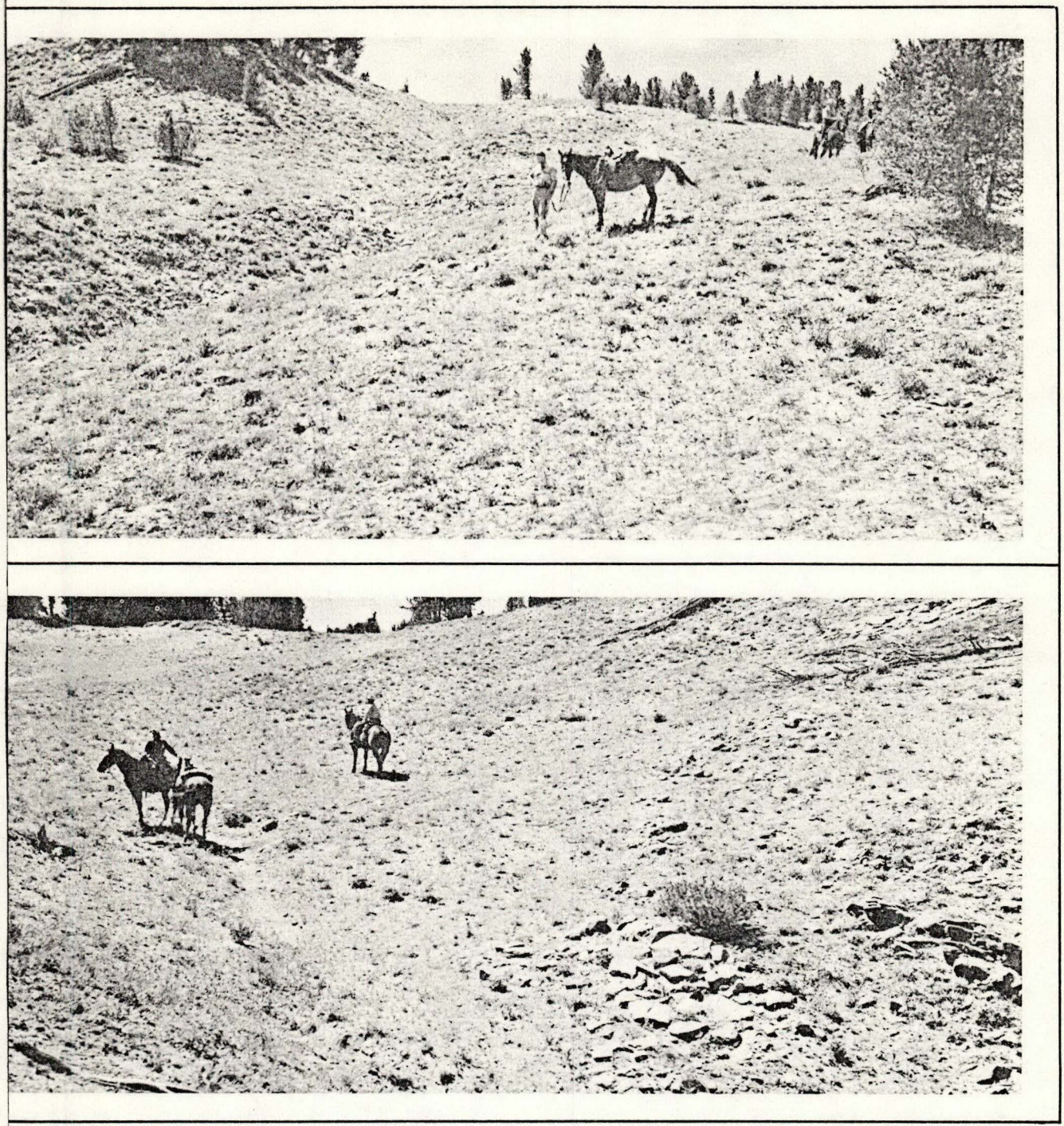

Figure 17.--Sparse vegetal cover, very largely annual weeds with a few scattered herbaceous shrubs, and bare soil in the head of Wolverine tributary G-2 above mud-rock flows shown in figure 15. The ridge in the background divides upper Wolverine drainage from the head of Snake River drainage approximately 4 miles south from the south boundary of Yellowstone National Park.

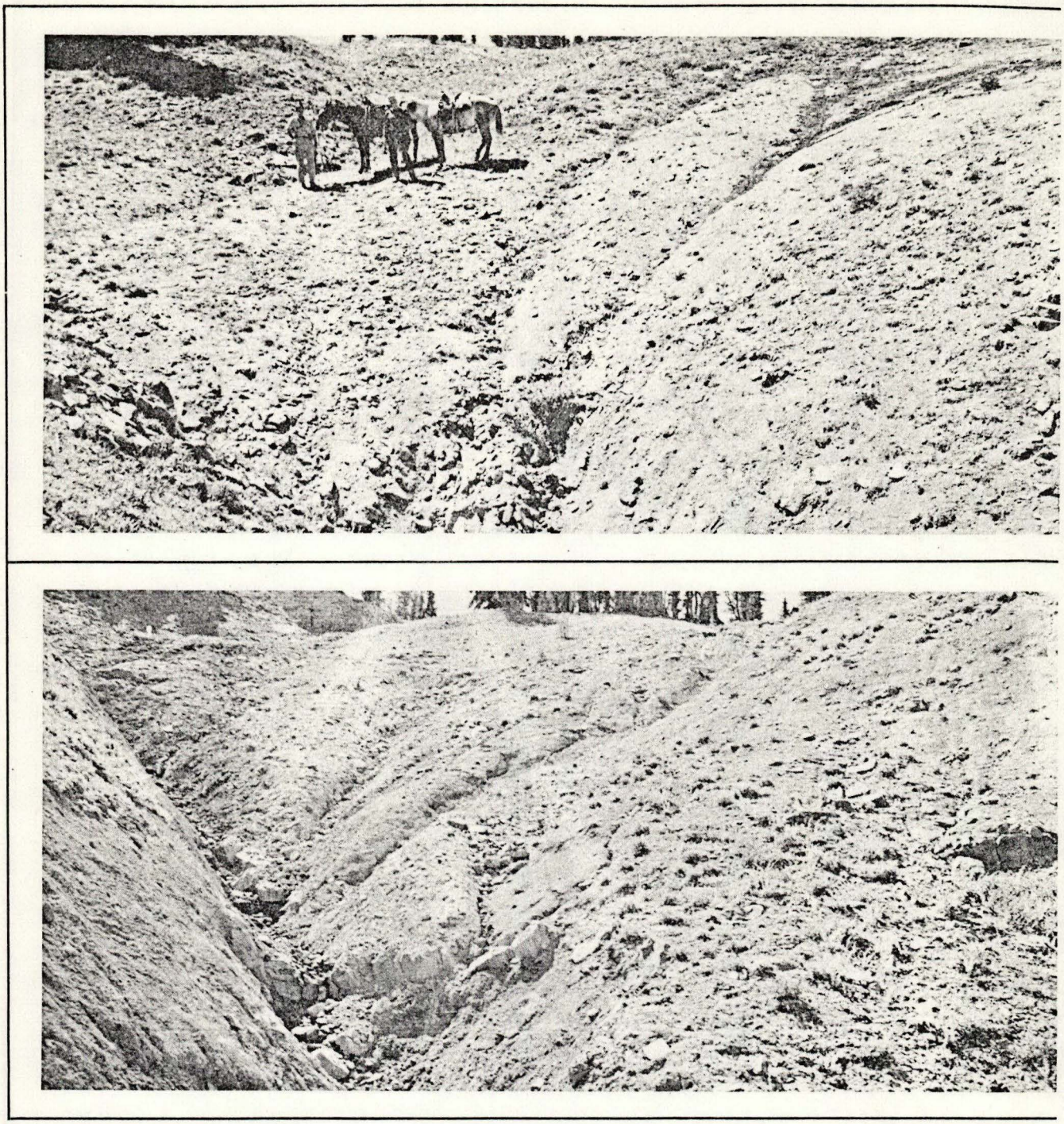

Figure 18.--Channel erosion about 400 feet downslope from location shown in figure 17.

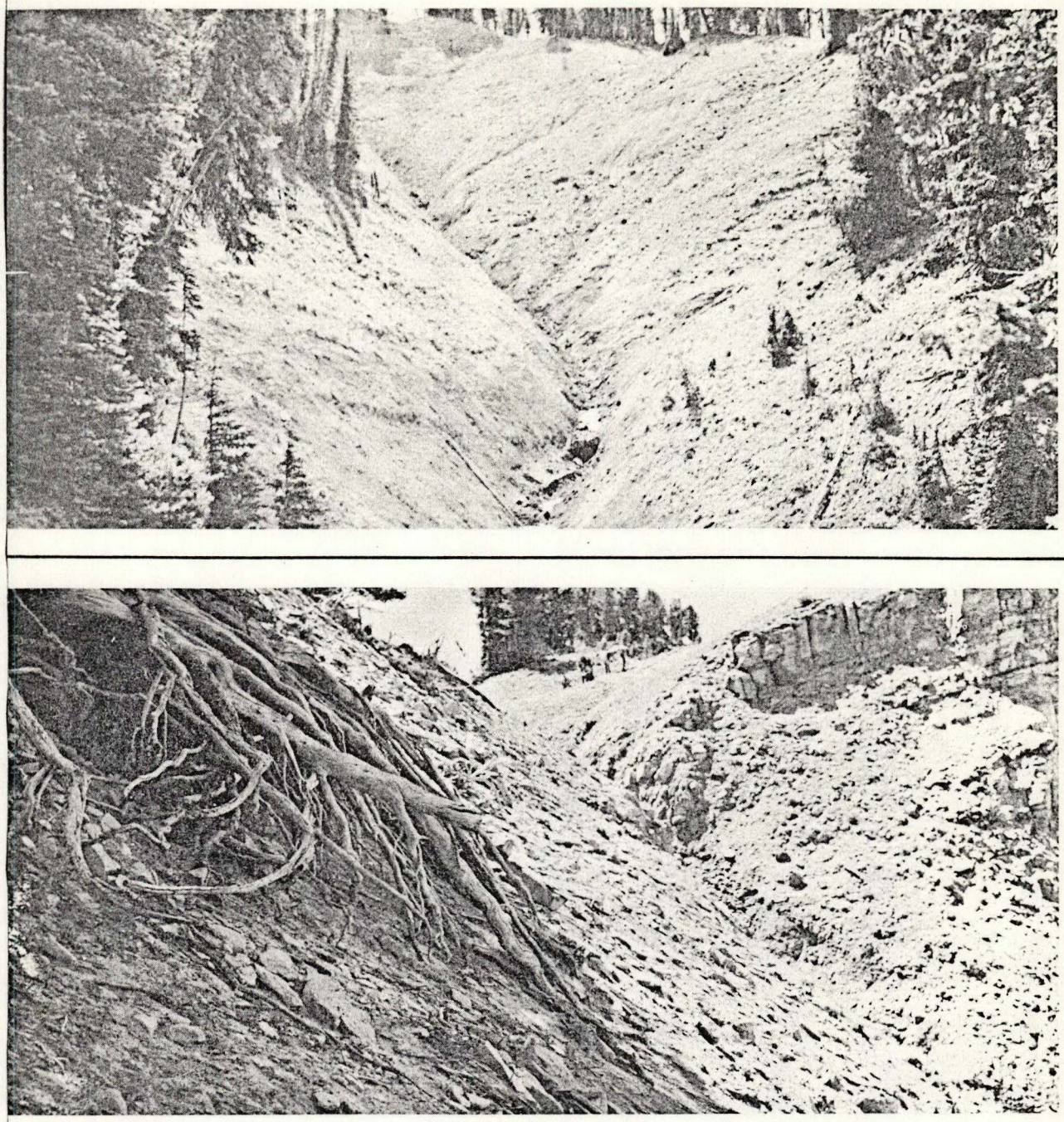

Figure 19.--Channel erosion in the head of Wolverine Creek, about 1,000 feet downstream from location shown in figure 18.

Figure 25.--Channels choked with boulders and logs as a result of concentration of oversurface flow from numerous small bare areas on watershed above.